

Writing Mathematical Equations in RMarkdown

Cheng Peng

STA 551 Foundations of Data Science

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1 Intorduction

This note list commands for creating mathematics formulas in RMarkdown.

2 Greek Letters

Symbol	Script
α	<code>\alpha</code>
A	<code>A</code>
β	<code>\beta</code>
B	<code>B</code>
γ	<code>\gamma</code>

Symbol	Script
Γ	<code>\Gamma</code>
π	<code>\pi</code>
Π	<code>\Pi</code>
ϕ	<code>\phi</code>
Φ	<code>\Phi</code>
φ	<code>\varphi</code>
θ	<code>\theta</code>

3 Operators

Symbol	Script
<code>cos</code>	<code>\cos</code>
<code>sin</code>	<code>\sin</code>
<code>lim</code>	<code>\lim</code>
<code>exp</code>	<code>\exp</code>
<code>→</code>	<code>\to</code>
∞	<code>\infty</code>
\equiv	<code>\equiv</code>
<code>mod</code>	<code>\bmod</code>
\times	<code>\times</code>

4 Power and Indices

Symbol	Script
k_{n+1}	<code>k_{n+1}</code>
n^2	<code>n^2</code>
k_n^2	<code>k_n^2</code>

5 Fractions and Binomials

Symbol	Script
$\frac{n!}{k!(n-k)!}$	<code>\frac{n!}{k!(n-k)!}</code>
$\binom{n}{k}$	<code>\binom{n}{k}</code>
$\frac{\frac{x}{1}}{x-y}$	<code>\frac{\frac{x}{1}}{x-y}</code>
$\frac{3}{7}$	<code>^3/_7</code>

6 Radical Roots

Symbol	Script
\sqrt{k}	<code>\sqrt{k}</code>
$\sqrt[n]{k}$	<code>\sqrt[n]{k}</code>

7 Sums, Integrals, and Related Symbols

Symbol	Script
$\sum_{i=1}^{10} t_i$	<code>\sum_{i=1}^{10} t_i</code>
$\int_0^{\infty} e^{-x}, dx$	<code>\int_0^{\infty} \mathrm{e}^{-x}, \mathrm{d}x</code>
\sum	<code>\sum</code>
\prod	<code>\prod</code>
\coprod	<code>\coprod</code>
\bigoplus	<code>\bigoplus</code>
\bigotimes	<code>\bigotimes</code>
\bigodot	<code>\bigodot</code>
\bigcup	<code>\bigcup</code>
\bigcap	<code>\bigcap</code>
\biguplus	<code>\biguplus</code>
\bigsqcup	<code>\bigsqcup</code>
\bigvee	<code>\bigvee</code>
\bigwedge	<code>\bigwedge</code>
\int	<code>\int</code>
\oint	<code>\oint</code>
\iint	<code>\iint</code>
\iiint	<code>\iiint</code>
$\int \dots \int$	<code>\idotsint</code>
$\sum_{0 < i < m, 0 < j < n} P(i, j)$	<code>\sum_{\substack{0 < i < m, \\ 0 < j < n}} P(i, j)</code>
\int_a^b	<code>\int \limits_a^b</code>

8 More Special Symbols

Symbol	Script
a'	<code>a^{\prime}</code>
a''	<code>a^{\prime\prime}</code>
\hat{a}	<code>\hat{a}</code>
\bar{a}	<code>\bar{a}</code>
\grave{a}	<code>\grave{a}</code>
\acute{a}	<code>\acute{a}</code>
\dot{a}	<code>\dot{a}</code>
\ddot{a}	<code>\ddot{a}</code>
\acute{a}	<code>\not{a}</code>
\mathring{a}	<code>\mathring{a}</code>
\overrightarrow{AB}	<code>\overrightarrow{AB}</code>
\overleftarrow{AB}	<code>\overleftarrow{AB}</code>
a'''	<code>a^{\prime\prime\prime}</code>
\overline{aaa}	<code>\overline{aaa}</code>
\check{a}	<code>\check{a}</code>
\vec{a}	<code>\vec{a}</code>
\underline{a}	<code>\underline{a}</code>
x	<code>\color{red}x</code>
\pm	<code>\pm</code>
\mp	<code>\mp</code>
$\int y dx$	<code>\int y \mathrm{d}x</code>

Symbol	Script
,	,
:	:
;	;
!	!
$\int y, dx$	<code>\int y, \mathrm{d}x</code>
...	<code>\dots</code>
...	<code>\ldots</code>
...	<code>\cdots</code>
⋮	<code>\vdots</code>
⋱	<code>\ddots</code>

9 Brackets

Symbol	Script
(a)	<code>(a)</code>
$[a]$	<code>[a]</code>
$\{a\}$	<code>\{a\}</code>
$\langle f \rangle$	<code>\langle f \rangle \rangle</code>
$\lfloor f \rfloor$	<code>\lfloor f \rangle \rfloor</code>
$\lceil f \rceil$	<code>\lceil f \rangle \rceil</code>
$\lrcorner f \urcorner$	<code>\lrcorner f \urcorner</code>

10 Matrices and System of Equations

10.1 Matrix

```


$$X_{m,n} =$$


$$\begin{pmatrix} x_{1,1} & x_{1,2} & \cdots & x_{1,n} \\ x_{2,1} & x_{2,2} & \cdots & x_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1} & x_{m,2} & \cdots & x_{m,n} \end{pmatrix}$$


```

produces

$$X_{m,n} = \begin{pmatrix} x_{1,1} & x_{1,2} & \cdots & x_{1,n} \\ x_{2,1} & x_{2,2} & \cdots & x_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m,1} & x_{m,2} & \cdots & x_{m,n} \end{pmatrix}$$

```


$$M =$$


$$\begin{bmatrix} \frac{5}{6} & \frac{1}{6} & 0 \\ \frac{5}{6} & 0 & \frac{1}{6} \end{bmatrix}$$


```

```

0 & \frac{5}{6} & \frac{1}{6} \\
\end{bmatrix}

```

produces

$$M = \begin{bmatrix} \frac{5}{6} & \frac{1}{6} & 0 \\ \frac{5}{6} & 0 & \frac{1}{6} \\ 0 & \frac{5}{6} & \frac{1}{6} \end{bmatrix}$$

10.2 Aligned Equations

```

Bias(\hat{\theta})   &= E(\hat{\theta}) - \theta \\
Bias(\hat{\theta})   &= E(2 \bar{X} - 1) - \theta \\
Bias(\hat{\theta})   &= \frac{2}{n} \sum_{i=1}^n E(X_i) - 1 - \theta \\
Bias(\hat{\theta})   &= 2E(X) - 1 - \theta \\
Bias(\hat{\theta})   &= 2 \cdot \frac{\theta + 1}{2} - 1 - \theta \\
Bias(\hat{\theta})   &= 0

```

Produces the following system of equations

$$\begin{aligned} \text{Bias}(\hat{\theta}) &= E(\hat{\theta}) - \theta \\ \text{Bias}(\hat{\theta}) &= E(2\bar{X} - 1) - \theta \\ \text{Bias}(\hat{\theta}) &= \frac{2}{n} \sum_{i=1}^n E(X_i) - 1 - \theta \\ \text{Bias}(\hat{\theta}) &= 2E(X) - 1 - \theta \\ \text{Bias}(\hat{\theta}) &= 2 \cdot \frac{\theta + 1}{2} - 1 - \theta \\ \text{Bias}(\hat{\theta}) &= 0 \end{aligned}$$

10.3 Piece-wise Function

```

f(x) = \begin{cases} \frac{1}{b-a} \\ 0 \end{cases}

```

produces the following piece-wise function

$$f(x) = \begin{cases} \frac{1}{b-a} \\ 0 \end{cases}$$

11 Pseudo-code of Algorithms

while not convergence:

 compute $\nabla(J)$

$\theta_0 := \theta_0 - \alpha \nabla(J)_0$

$\theta_1 := \theta_1 - \alpha \nabla(J)_1$

end while